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Corporate Vulnerability and Bank Stability

Evidence from Jordan

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Abstract

This paper uses data on publicly listed companies in Jordan to evaluate corporate vulnerability and perform corporate stress testing. The exercise finds that both earnings and interest rate shocks have significant impact on corporate vulnerability. Because different banks have different sector exposures, and different sectors exhibit different vulnerability at different times, the stress tests that include corporate exposure will provide a more precise evaluation of bank soundness.

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Corporate Vulnerability and Bank Stability: Evidence from Jordan

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Introduction

The soundness of the banking sector depends on prudential lending practices and on the soundness of the borrowers. Systemic shocks to the borrowers' ability to repay their loans will be transmitted to banks through corporate defaults, thus affecting banks' soundness. Traditionally, bank stress testing does not include corporate stress testing. However, including corporate vulnerability in the evaluation of bank stability could provide a more precise measure of vulnerability in banking and allow policymakers to take necessary steps to prevent bank crises.

This paper offers a simple methodology for evaluation of the soundness and vulnerabilities in corporate sector, which can then be linked to bank stress testing. The paper uses data from Jordan to demonstrate the methodology.

There are two reasons to perform such corporate vulnerability assessment: First, using corporate data is likely to strengthen bank stress testing exercises since it provides an independent way to assess the assumptions about the impact of shocks. Second, Jordan is a particularly suitable country for this exercise because there is an active stock exchange with data on over 150 listed non-financial companies publicly available for 2000-2006.

The paper will proceed in three sections. First section presents benchmarking of corporate vulnerability in Jordan against comparable countries using Worldscope data. Second section contains detailed analysis of corporate vulnerability using firm-level data on publicly listed firms (available from ASE). Specifically, measures of vulnerability will include leverage, performance, growth, and interest coverage (ability to repay the debt). These measures will be broken down by sector, firm size and over time. Third section contains corporate stress testing, investigating the impact of interest rate and earnings shocks on corporate vulnerability measures.

2. Cross-Country Benchmarking of Corporate Vulnerability

This section compares key vulnerability ratios in Jordan and four comparator countries with available data: Egypt, Israel, Morocco and Turkey. The analysis relies on publicly available data through the Worldscope database, which contains data on largest, most liquid public firms for which there is foreign investor interest.

Table 1 reports the sample composition of the data available in Worldscope at the time of this report (end of September 2008). There are two main observations from this table. First, Jordan seems to be lagging in terms of timeliness of data reporting. At the end of third quarter of 2008, only 11% of all firms in the database have data for 2007 in Jordan. For other countries this percentage is much larger – 32% for Morocco, 54% for Egypt and over 90% for Israel and Turkey.

Table 1. Sample Composition and Timeliness of Data Reporting

Country	Number of firms in 2006	Number of firms in 2007	Percent of firms with data for 2007	Financials (in 2006)	Percent of sample that are financials (2006)
Jordan	36	4	11%	18	50%
Morocco	22	7	32%	8	36%
Egypt	54	29	54%	13	24%
Israel	170	160	94%	17	10%
Turkey	210	217	103%	40	19%

Source: Worldscope, September 2008.

A second observation is about the sample composition. In Jordan in 2006, of 36 firms represented in the sample, 18 are classified as financials (including 11 banks and 7 non-bank financials). Thus, 50% of Jordan sample in Worldscope are financial companies. This percentage is much larger than in other countries, it is 36% in Morocco, 25% in Egypt and less than 20% in Israel and Turkey. The Worldscope represents largest listed companies with investor interest (since the customers of worldscope are international investors). It is important to understand further why financial companies in Jordan are overrepresented in the international database, such as Worldscope.

This assessment primarily focuses on the non-financial corporate sector (as financial companies are analyzed elsewhere). Therefore for increased comparability, we limit cross-country benchmarking to non-financial companies. Table 2 reports key vulnerability ratios for non-financial companies in Jordan. Below we discuss main vulnerability ratios.

High profitability makes the defaults less likely and gives a sense of the overall soundness of the corporate sector. A common measure of profitability is Return on assets, ROA, defined as net income over total assets. It measures the efficiency with which the company is

using its assets. Low ROA indicates low productivity and thus potential vulnerability to shocks and financial difficulties. Jordan reports healthy average profitability of around 6%, which compares well with Israel and Turkey, but below that reported in Morocco and Egypt.

Leverage is one of the key measures of corporate vulnerability. High leverage suggests higher risk of insolvency in response to shocks that reduce the value of assets relative to liabilities. Two main measures of leverage are total debt to assets and total liabilities to assets.[2] In Jordan these ratios are relatively low. In fact, these ratios are the lowest of all the comparator countries, only 24% for total debt and about 30% for total liabilities, scaled by assets. While these ratios do not suggest high vulnerability in Jordan, they might point to difficulty with obtaining debt financing, which affects even the largest corporations that are represented in the Worldscope.

While total leverage shows the overall indebtedness of the company, the maturity structure of the debt is also an important factor in determining corporate vulnerability. Short-term debt makes companies more vulnerable to hikes in interest rates and credit crunches that may reduce creditor's willingness to roll over short-term debt. In Jordan firms have very high proportion of short-term leverage. The ratio of current liabilities to total liabilities is above 80%, which is the largest of all comparator countries, closely followed by Morocco. The ratio of short-term debt to total debt is also quite high – at 68%, which is just below Morocco at 70% and higher than in other comparator countries.

While the total levels of debt and leverage do not indicate high vulnerability in Jordan, high proportions of short-term debt and short-term leverage might be a source of concern from stability perspective (as they make companies more vulnerable to shocks) and from developmental perspective (as inability to raise long-term financing might slow down the potential growth).

[2] To increase comparability with Stock exchange data discussed in the next section, the total debt is estimated as total liabilities minus accounts payable, which is trade credit.

Table 2. Cross-Country Comparison of Key Vulnerability Ratios

Country	Jordan	Egypt	Israel	Morocco	Turkey
Return on Assets	6.1%	12.4%	1.8%	10.7%	4.2%
Total Debt (estimated) to Assets	24%	40%	45%	27%	35%
Total Liabilities to Total Assets	30.1%	47.6%	49.0%	40.3%	45.9%
Current Liabilities to Total Liabilities	81.5%	76.4%	67.9%	79.5%	73.4%
Short-term Debt to Total Debt	67.9%	43.6%	47.2%	69.9%	65.4%
Quick Ratio	1.92	1.13	2.80	.	1.71
Interest Coverage	8.96	7.03	3.60	73.15	3.39
Interest Coverage Less than 0.75	0.0%	0.0%	23.4%	0.0%	23.6%
Altman Z-score	5.46	4.61	3.02	.	3.62
Percent Float	52.7%	35.6%	45.8%	28.7%	36.4%
N obs (based on total debt)	18	39	149	14	168

Source: Worldscope Data

Quick Ratio is a measure of liquidity, which plays a role of a buffer against shocks to financing and cash flows. It's defined as the ratio of current assets, minus inventories, over current liabilities. The quick ratio measures a company's ability to meet its short-term obligations with its most liquid assets. The higher the quick ratio, the better the liquidity of the company. Jordan reports a fairly high quick ratio of 1.92, which suggests that companies have nearly twice the amount of liquid assets to liquid liabilities and are well positioned to cover liquid liabilities with liquid assets. This is above Egypt and Turkey, while below Israel.

An important measure of corporate ability to repay its debt obligations is Interest Coverage Ratio (ICR), defined as EBITDA – Earnings before Interest, Taxes, Depreciation and Amortization – over interest expense. Interest Coverage shows the ability to cover interest expenses using the current period earnings. The average interest coverage in Jordan is relatively high – 8.96, which is the highest (except Morocco, which contains a number of outlier observations with very low interest payments).

While the average interest coverage is useful for determining how vulnerable the average firm is, it is also important to know how many firms have dangerously low interest coverage, i.e. statistically speaking, what is the low end of the distribution of interest coverage. The interest coverage below one might indicate that the firm will find it difficult to cover interest payments with current earnings, and may fall into arrears. However, the firm might still be able to cover interest by using some liquid assets. Therefore the ratio of interest expense below 0.75 is a more

conservative measure. If interest coverage falls below 0.75, it is highly likely that the firm will experience financial distress. The threshold of 0.75 is used in Jones and Karasulu (2006) who argue that it provides a better mapping to the NPL ratios by banks. Among the 18 firms available in the Worldscope no firm has interest coverage below 0.75, while 2 firms have relatively low interest coverage between 1 and 1.5. Based on the interest coverage ratios firms in Jordan appear healthier or comparable to other countries.

Finally, Altman's Z-score is an aggregate measure of vulnerability, which takes into account several key ratios used to predict corporate default in the US and other countries.[3] In Jordan the average Altman Z-score ratio for the 18 non-financial companies in Worldscope is the highest in the region, which means these are on average the healthiest firms relative to comparable countries.

Based on the Wordscope data the benchmarking exercise shows that firms in Jordan show relatively low vulnerability. The one point of concern and further investigation are high proportions of short-term debt.

However, this analysis is limited to 18 Jordanian firms available in Worldscope. The results are thus subject to small sample concerns. These 18 firms are the largest of the listed non-financial firms – they comprise about 60% of total assets of all non-financial firms listed on ASE. Therefore they are not very representative of the total population of firms listed on ASE (although from the systemic perspective these firms are the most important). Below we perform more in-depth analysis for all listed firms on ASE.

3. In-depth Analysis of Corporate Vulnerability in Jordan

Data on public firms available from ASE (Amman Stock Exchange) allow for more in-depth analysis of corporate vulnerability across different sectors, firm size and over time.

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[3] Altman's Z-score is given by the formula :

Z-score=0.717*WC_TA + 0.847*RE_TA+ 3.107*ROA+ 0.420*BVE_TL+0.998*S_TA

where, WC_TA is working capital (defined as current assets minus current liabilities over total assets), which is another measure of liquidity, ROA is return on assets, RE_TA is the ratio of retained earnings over assets (which reflects cumulative performance over time), BVE_TL is the ratio of book value of equity over total liabilities (a measure of indebtedness similar to the ratio of total liabilities to total assets) and S_TA is a ratio of total sales over total assets. See Altman(2000) and Altman and Hotchkiss (2005).

3.1 Sector Breakdown

The sector breakdown of ASE data is matched to the classification followed by banks in monthly reporting of sector exposures. The advantage of this method is that industry-level results could be directly matched with bank exposure and allow for integration of industry vulnerability analysis into the bank stress-testing exercise. The disadvantage is that some industry brackets end up with very few firms, while others represent fairly heterogeneous groupings. For example, in 2006 there are only 4 firms in the sector labeled "utilities and energy," while there are 49 firms lumped together under "industry" which is fairly heterogeneous group (i.e. it includes such industries as chemicals, textiles, electronics, machinery, food processing and others).[4] The results for sectors with very few observations should be treated with caution, especially for the utilities and energy sector.

Table 3 reports the results of several key vulnerability ratios by sector in 2006. The last column reports averages across all industries.

Profitability is an important measure of sector performance and potential to meet its debt obligations. Among the sectors considered, the highest profitability is observed in the mining and financial sectors, which report 3.8% and 3.9%, respectively. Industry and trade on average reports ROA of about 1%, which is low by international standards, as shown above. Transportation is the lowest, with an ROA of 0.3% in 2006. The overall ROA for all listed firms is lower than reported above for the 18 firms available in Worldscope.

In terms of liquidity, tourism and hotels, utilities and real estate companies have the highest quick ratio, i.e. highest ability to meet current liabilities with current assets. Industry, construction and transportation have lower quick ratios, just barely above one on average. These companies are less liquid, and hence more vulnerable to shocks to short-term financing or cash flows.

The overall level of indebtedness is an important factor in evaluating corporate vulnerability. Two measures of total indebtedness are total debt to assets, and total liabilities to

[4] The category Financials only contains companies classified as real estate and diversified financial services. The focus of this report is on non-financial corporate sector.

assets.[5] The average levels of total liabilities and total debt to assets are comparable to those reported above for a smaller subsample of firms available in Worldscope.

In 2006, utilities and energy report the highest total debt and total liabilities levels followed by construction and transportation. The lowest levels of debt are observed in mining, industry, and trade, and the lowest in tourism and hotels.

As discussed above, while the total levels of debt are fairly low in Jordan, relative to several comparable countries, the levels of short-term debt are relatively higher. The ratio of current liabilities to total liabilities is above 80% on average for the whole sample, and it is highest in industry (almost 90% of total liabilities are current), followed by mining and trade. It is lowest in tourism and hotels and utilities and energy.

Table 3. Industry Breakdown of Corporate Vulnerability Ratios, 2006

	1. Mining	2. Industry	3. General /Services	4. Construction	5. Transportation	6. Tourism and Hotels	7. Utilities and Energy	8. Financial/ Real Estate	All
ROA	3.9%	1.4%	1.2%	2.9%	0.3%	1.3%	2.2%	3.8%	2.3%
Quick Ratio	2.6	1.6	3.0	1.3	1.5	6.6	8.7	7.2	4.0
Current Liabilities to Total Liabilities	86%	89%	85%	79%	77%	63%	63%	80%	83%
Total Liabilities to Total Assets	24%	30%	33%	39%	39%	16%	63%	26%	30%
Total Debt (estimated) Over Total Assets	17%	22%	24%	31%	31%	16%	46%	21%	23%
Interest Coverage	8.7	2.8	15.1	10.1	5.4	6.6	8.5	15.4	9.3
Interest Coverage Less than 0.75	9%	25%	24%	22%	30%	13%	0%	22%	22%
Uncovered Debt Ratio (Interest Coverage < .75)	0.5%	19%	21%	27%	3%	7%	0%	24%	18%
Altman Z-score	8.0	4.6	4.9	4.4	9.1	5.0	1.1	5.9	5.4
Number of Observations*	11	48	24	9	10	7	4	51	164

Interest coverage shows the ability to cover interest expenses using the current period earnings. Interest coverage is the highest in financial firms, followed by trade and construction. It is lowest in industry- only 2.8 on average, followed by transportation and tourism and hotels.

[5] In ASE data there is no line item such as total debt. We have calculated total debt as total liabilities minus accounts payables, which represent trade credit.

The proportion of firms with industry coverage below one is an important indicator of the proportion of firms that are below the threshold of interest coverage that is considered safe. As a conservative estimate, the threshold of 0.75 is used, following Jones and Karasulu (2006). The transportation sector stands out with the highest proportion of firms with low interest coverage – at 30%, closely followed by industry, at 25%. The better performers on this measure are mining and tourism and hotels (close to 10%) and utilities and energy (only 4 firms in that category and not one has interest coverage below 0.75).

However, the proportion of firms that falls below the threshold for ICR does not take into account different firm size, or more precisely the amount borrowed by different firms. For example, take two industries in which 20% of all firms have ICR below the threshold of 0.75. However, in one industry these 20% are some of the smallest firms in the industry, with small amount of total debt, which in the other industry these 20% of affected firms are some of the largest firms in the industry. The different debt exposure needs to be weighed in in the assessment of sectoral vulnerability. This problem is addressed by the metric referred to as the uncovered debt ratio, discussed below.

The uncovered debt ratios (UDR) shows a proportion of industry-debt for which earnings (EBTDA) do not adequately cover the interest payments. It is measured by ratio of total debt of firms with interest coverage below 0.75 to total debt of all firms in the industry. Thus, it takes into account the relative sizes of debt. The UDR measure provides a useful proxy for underlying credit quality in the corporate sector.[6]

Based on this metric, construction is the most vulnerable sector, with a UDR of 27%, followed by th financial sector with a ratio of 24%. Trade and industry have UDR's close to 20%. utilities and energy and mining report UDR's close to zero.

Finally, Altman's Z is an aggregate measure of vulnerability, which takes into account several key ratios used to predict corporate default in the US and other countries. According to this measure, the transportation and mining sectors score well (with scores of 9 and 8

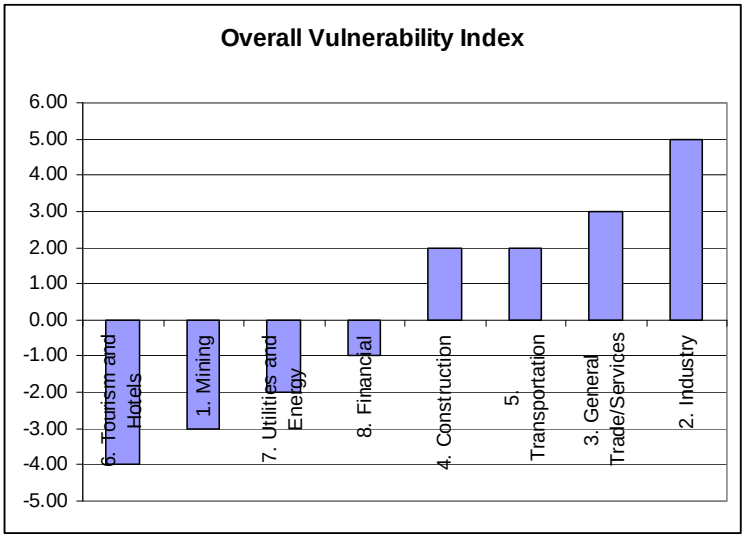
[6] The UDR is not reported for Worldscope analysis because it was zero for Jordan since no firm fell below the threshold for interest coverage.

respectively), while utilities and energy score very poorly, with a score of 1. Industry, trade and construction are all on the low side.

So far, out of 9 different measures considered, some sectors score well on some measures, while they score poorly on other measures. To aggregate the results in a simple index, we add the number of times the sector is noted as having high vulnerability and subtract the number of times that sector is noted as low vulnerability. The overall vulnerability index then shows the net effect of different measures. Positive overall index suggest that the sector is more often noted as having higher vulnerability, while negative overall index shows overall lower vulnerability.

Figure 1 plots the values of the overall vulnerability index. The industrial sector turns out to have the highest vulnerability, followed by trade, transportation and construction. Other sectors present lower overall vulnerability. Note that these results are static, for the end of 2006.

Figure 1. Overall Vulnerability Index



Source: ASE data

An important caveat to consider is that some of these sectors are not homogeneous. Thus the sector referred to as industry contains 48 firms, out of which 11 are in the chemical industry, 11 are in food processing, 7 are in the medical and pharmaceutical industry and a smaller number of firms are spread out in other industries. In the financial sector 27 firms are in real estate, while 24 are in diversified financial services. Different industries might be differentially affected by

macroeconomic conditions in Jordan and world-wide. Therefore the aggregate numbers might mask vulnerabilities in some specific sub-sectors.

Below we break down three of largest sectors - industry, trade and finance into several sub-sectors.[7] Results for these subsectors are reported in Table 4.

There is some variation among sub-sectors within each sector. For example within the industrial sector, chemical industries report significantly higher proportion of firms with low interest coverage and higher uncovered debt ratios than other sub-sectors. Food and beverage also report high uncovered debt ratio. Thus, two sub-sectors are significantly different than the rest of the firms within the industrial sector.

Similar differences are observed in other sectors. Thus in trade, commercial services appear to be more vulnerable than non-commercial services (which is the aggregate of other sub-sectors within trade sector): Commercial services report 50% uncovered debt ratio, while non-commercial it is only 11%. Within the financial sector real estate performs better than diversified financial services – those companies have higher ROA, lower debt, higher interest coverage and lower uncovered debt.

[7] Category referred to as "other industry" aggregates a number of sub-sectors that are too small to consider individually (paper and paper products, textiles, electronics and others).

Table 4. Sub-sector Breakdown of Corporate Vulnerability Ratios for Selected Sectors, 2006

	Industry				Trade		Financial	
	Chemical Industries	Food and Beverage	Pharmaceutical and Medical	Other industry	Commercial Services	Non-commercial service	Diversified Financial Services	Real Estate
ROA	0.2%	0.3%	5.2%	1.4%	0.9%	1.4%	2.3%	5.1%
Quick Ratio	1.6	1.6	2.9	1.2	4.9	1.7	5.8	8.5
Current Liabilities to Total Liabilities	90%	92%	88%	88%	85%	86%	80%	81%
Total Liabilities to Total Assets	29%	33%	27%	30%	38%	30%	30%	23%
Total Debt (estimated) Over Total Assets	22%	23%	21%	23%	27%	21%	23%	19%
Interest Coverage	5.1	-2.9	2.9	4.0	3.9	20.8	3.4	26.0
Interest Coverage Less than 0.75	45%	18%	14%	21%	20%	27%	25%	19%
Uncovered Debt Ratio (Interest Coverage < .75)	66%	45%	13%	10%	50%	11%	31%	9%
Altman Z-score	4.0	6.2	6.8	3.3	4.5	5.1	5.2	6.4
Number of Observations*	11	11	7	19	10	14	24	27

Since some of the broad sector groupings are fairly heterogeneous, it might be beneficial for more precise reporting and surveillance, to request further break-down of industrial and service groups into several sub-categories, based on actual industrial composition in Jordan. As discussed below, these are also the sectors with large bank exposures.

3.2 Evolution of Vulnerability Measures over Time

Table 5 reports the average of several vulnerability ratios for all firms across the period 2000-2006. The last column reports the averages across all years.[8]

The years with the highest profitability, as measured by the return on assets, are 2004 and 2005 with an ROA of 6.5%, while 2000 has the lowest profitability, with an ROA of 0.7%. Profitability has declined to 2.2% in 2006. In terms of liquidity, as measured by the quick ratio,

[8] This table is limited to balanced panel to increase across-years comparability (so the data for 2006 are not the same as in Table 3, which included all firms in 2006 with available data).

Jordanian firms were most liquid in 2004, just when profitability peaked, with a quick ratio of 6.0. Firms were the least liquid in 2006, with a quick ratio of 3.5.

Total indebtedness is fairly constant across time, with total liabilities to total assets being fairly close to 29% and total debt over total assets hovering close to 21%. As mentioned in the previous section, short-term indebtedness is fairly high at an average of 80% and is fairly stable over time, with the highest number of 82% recorded for 2006.

Interest coverage, the ability of a firm's current earnings to pay off its interest payments, is highest in 2004, corresponding to the beginning of peak profitability, at an average of 23.8. Firms have the least ability to meet current interest expenses in 2006 with interest coverage of 6.0. While the debt levels are fairly stable over time, interest coverage is highly volatile, which is due to volatile earnings. This volatility is a concern, as highly volatile earnings may lead to inability to cover interest payments.

The proportion of firms that are in danger of not meeting their interest expenses is highest during 2000-2001, the times of lowest profitability. Then this proportion steadily declines until 2005 with a minimum of 10%. However, it jumps back to 23% in 2006.

As noted before, uncovered ratio takes into account firm size and level of debt. UDR has been lower in the later part of the decade, with lowest levels observed in 2005. Altman's Z, a measure of vulnerability that uses several important ratios, is lowest for 2006.

Overall, the time-series analysis shows higher vulnerability in 2006 based on several indicators – lower profitability, lower liquidity, lower interest coverage, higher proportion of short-term debt, higher proportion of firms with ICR below 0.75 and lower Altman Z-score. These signs point to increasing vulnerability in 2006, which is a source of concern.

Table 5. Evolution of Vulnerability over Time

Year	2000	2001	2002	2003	2004	2005	2006	All
ROA	0.7%	1.9%	2.3%	5.1%	6.5%	6.5%	2.2%	3.6%
Quick Ratio	4.6	5.7	4.8	5.0	6.0	4.4	3.5	4.8
Current Liabilities to Total Liabilities	81%	80%	77%	80%	79%	81%	82%	80%
Total Liabilities to Total Assets	29%	29%	29%	29%	32%	28%	29%	29%
Total Debt (estimated) Over Total Assets	21%	22%	22%	21%	21%	20%	22%	21%
Interest Coverage	15.0	6.6	19.6	16.2	23.8	21.4	6.0	15.2
Interest Coverage Less than 0.75	26%	30%	25%	18%	13%	10%	23%	20%
Uncovered Debt Ratio (Interest Coverage < .75)	39%	17%	18%	22%	10%	6%	10%	20%
Altman Z-score	7.5	5.9	6.9	7.6	8.0	8.3	5.4	7.1
Number of Observations*	114	114	113	114	114	115	113	797

3.3 Analysis of Vulnerability by Size

Table 6 reports the average of the vulnerability ratios by firm size, as measured by total sales, for Jordanian firms in the ASE in 2006. The sample is divided in 4 equal quartiles, where quartile 1 contains the smallest firms and quartile 4 contains the largest. The last column presents the overall averages for comparison.

There is a clear positive relationship between firm size and profitability, as measured by the ROA: the smallest firms, those in the first quartile, have negative profitability, with an average ROA of -1.6%, while the largest firms, those in the fourth quartile, have the highest ROA (7.3%). The smallest firms have negative ROAs.

Like profitability, total indebtedness has a positive relationship with firm size. The ratio of total liabilities over total assets is highest at 40% for the fourth quartile, while it is the lowest at 24% for the first quartile. Total debt over total assets is highest at 31% for the fourth quartile, but the first and second quartiles have the lowest ratios at 19%. Lower indebtedness for smaller firms explains their higher liquidity levels – they have more assets then liabilities, likely due to their inability to obtain credit.

In terms of short-term indebtedness, as measured by current liabilities over total liabilities, there is not a distinct relationship with firm size, but an upside-down U-shape. The

highest short-term indebtedness is 89% for the second quartile of firms, and is roughly equal for the first and third quartiles, with current liabilities over total liabilities of 82% and 83% respectively. The fourth quartile of firms has the least short-term indebtedness, with current liabilities over total liabilities of 78%. Thus, largest firms are better able to obtain longer term financing then medium and smaller firms.

Interest coverage, the ability of firms to meet interest expenses using current earnings, increases as firm size increases, following the same pattern as profitability. Interest coverage is lowest for the first quartile at 3.3, while it is highest for the fourth quartile at 23.9. Thus, even though smaller firms have lower debt, they have less ability to cover the interest payments on their debt.

The proportion of firms with interest coverage less than 0.75 has a similar relationship: Larger firms are less likely to be vulnerable than smaller firms. A greater proportion of firms at the first quartile are unlikely to meet their interest expenses, while a smaller proportion of firms at the fourth quartile are unlikely to meet their interest expense: 28% and 10% respectively.

Accounting for the different debt loads of firms by using the Uncovered Debt Ratio, again, the largest firms are less vulnerable than the smallest firms. The UDR for firms in the first quartile is 38%, it is only 7% in third and 9% in the fourth quartile. Altman Z-score does not have a clear patter with size.

To summarize this section, smaller firms are less profitable, have lower debt, but higher vulnerability (lower interest coverage and higher uncovered debt ratios.)

Table 6. Vulnerability by Firm Size (Sales) in 2006

	First Quartile (smallest)	Second Quartile	Third Quartile	Fourth Quartile (Largest)	All
ROA	-1.6%	1.8%	3.2%	7.3%	2.7%
Quick Ratio	6.4	4.7	2.5	1.5	3.8
Current Liabilities to Total Liabilities	82%	89%	83%	78%	83%
Total Liabilities to Total Assets	24%	26%	32%	40%	30%
Total Debt (estimated) Over Total Assets	19%	19%	25%	31%	23%
Interest Coverage	3.3	6.6	8.9	23.9	11.5
Interest Coverage Less than 0.75	28%	23%	20%	10%	20%
Uncovered Debt Ratio (Interest Coverage < .75)	38%	30%	7%	9%	21%
Altman Z-score	6.6	5.8	4.6	5.2	5.4
Number of Observations*	39	39	40	40	158

3.4 Key Measures of Corporate Vulnerability

This section describes two key measures that will be used below in corporate stress testing and bank stress testing.

The proportion of firms in the industry that find it difficult to meet their interest payments with current earnings, i.e. for which interest coverage ratio falls below a certain threshold (such as below 1, or below 0.75) is one metric of sectoral level vulnerability. The higher proportion of firms in the industry that find it difficult to meet their interest payment, the more vulnerable that industry is, and the higher risk the banks with higher exposure to that industry will bear.

Table 7 reports proportion of firms with interest coverage below 0.75 by sector in 2006 (the latest year with corporate data) along with the number of firms in each sector. (Table 7 simply replicates several rows from Table 3 above). The transportation sector has the largest proportion of firms with industry coverage below 0.75: 30% of all firms, followed by industry, 27%, services and construction at 22%.

Table 7. Proportion of Firms with Industry Coverage below 0.75 by Sector, in 2006

	Proportion of firms with ICR <0.75	UDR	Number of Firms
1. Mining	9%	0.5%	11
2. Industry	25%	19%	48
3. General Trade/Services	24%	21%	24
4. Construction	22%	27%	9
5. Transportation	30%	3%	10
6. Tourism and Hotels	13%	3%	7
7. Utilities and Energy	0%	0%	4
8. Financial/Real Estate	22%	9%	51
Total over all sectors:	**22%**	**18%**	**164**

Uncovered Debt Ratios (UDR) is a metric that shows a proportion of industry-debt for which earnings (EBTDA) do not adequately cover the interest payments. The UDR measure provides a useful proxy for underlying credit quality in the corporate sector.

If banks have equal exposures to all firms in the sector, the UDR is a better measure of corporate vulnerability that would better predict bank NPL's. However, different banks might have different exposures to firms in the same sector. Nevertheless, UDR shows the overall level of vulnerability in the sector.

The exact definition of UDR follows Jones and Karasulu (2006) who define it as a proportion of total industry debt for which ICR is less than 0.75.[9]

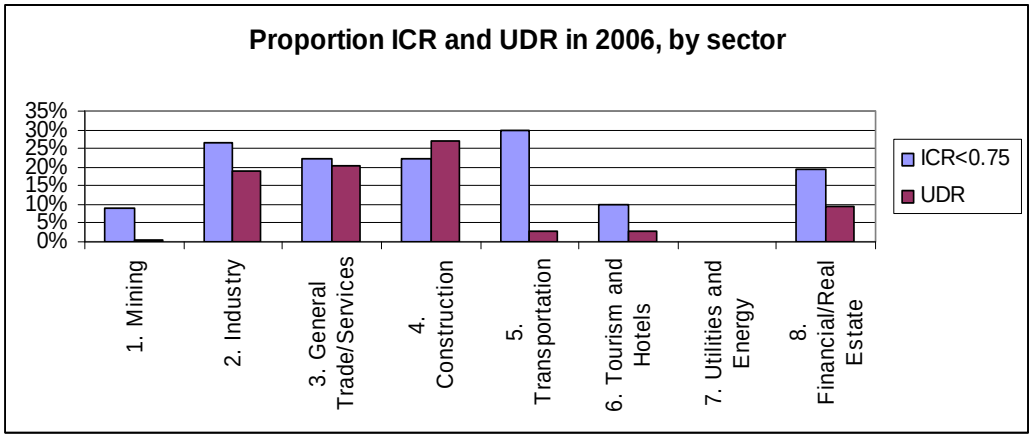
Table 7 above also reports UDR by sector, for 2006. Using this metric, construction becomes the sector that shows most vulnerability – close to 30% of all industry debt is uncovered (i.e. interest coverage is below 0.75). General industry and general trade (i.e. services) each have close to 20% of all debt classified as uncovered. In contrast, transportation, which had the highest proportion of ICR firms has a minor UDR of close to 3%. This is because the 30% (i.e. 3 out of 10) firms in transportation industry with ICR below 0.75 turn out to be the smallest firms

[9] Specifically, the UDR is the ratio of sum of industry debt for all firms for which ICR is below 0.75 over total debt of all firms in the industry. Note that official data do not report a balance sheet entry called total debt. To impute the total debt levels, we take total liabilities and subtract accounts payable. This roughly represents firm level interest-bearing debt.

in that sector. So on average, transportation industry appears healthier because largest firms in that industry are healthier.

Figure 2 below contrasts proportion of firms with ICR below 0.75 and the UDR.

Figure 2. Proportion of Firms with ICR below 0.75 and the Total UDR



Source: ASE data, own calculations.

4. Shocks to Corporate Vulnerability

In this section we use corporate data to evaluate of the impact of shocks on corporate ability to repay debt. The ICR and UDR are used as two metrics to see the impact on corporate vulnerability of shocks to corporate sector.

4.1 Interest Rate Shocks

Here we investigate two possible scenarios for interest rate shocks: increase in interest rates by 4% or 8%. These two shocks would directly affect corporate ability to repay their debts, and be reflected in the proportion of firms with ICR below the threshold and the sectoral level UDR.

To evaluate the impact of shocks the following procedure is adopted.

1. Calculate current imputed interest rate by dividing reported interest expense over estimated total debt.

2. Assume an increase in the imputed interest rate of 4% or 8%, depending on scenario.[10]

3. Recalculate new interest payment assuming increased interest rate (i.e. new interest payments equals new interest rate times total debt).

4. Recalculate new interest coverage ratios using new interest expense. Recalculate new proportion of firms with interest coverage below 0.75 and new uncovered debt ratio.

5. Compare new uncovered debt ratios for shocks scenarios of increased interest rates by 4% and 8% to the baseline (i.e. actual 2006 data).

The results of this simulation exercise are reported in Table 8. The results of the simulation exercise show that most vulnerable sectors are: construction, finance, industry and trade.

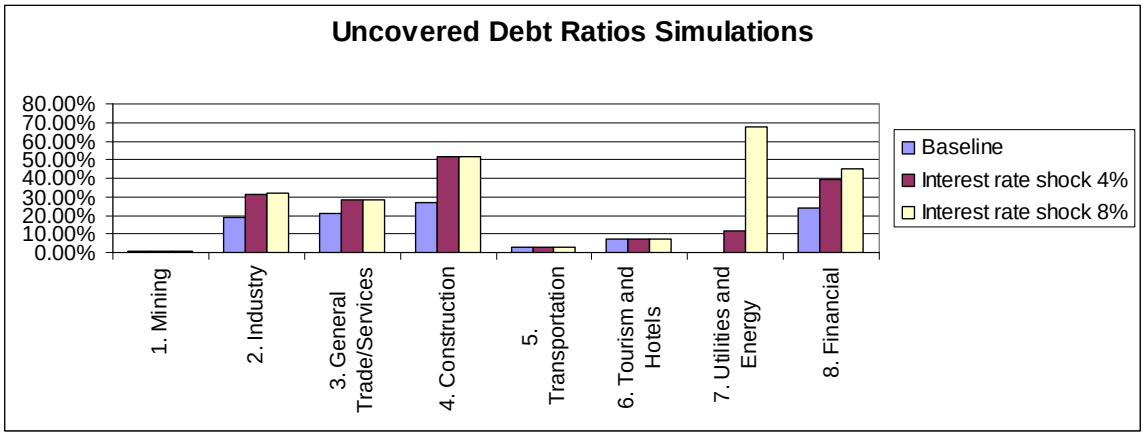
Table 8. Simulation of Interest Rate Shocks

	UDR			Proportion of firms with ICR below 0.75		
Sector	**Baseline**	**Interest rate shock 4%**	**Interest rate shock 8%**	**Baseline**	**Interest rate shock 4%**	**Interest rate shock 8%**
1. Mining	0.5%	0.5%	0.5%	9%	9%	9%
2. Industry	19%	31%	32%	25%	32%	34%
3. General Trade/Services	21%	28%	28%	24%	28%	28%
4. Construction	27%	27%	52%	22%	33%	33%
5. Transportation	3%	3%	3%	30%	30%	30%
6. Tourism and Hotels	7%	7%	7%	12.5%	12.5%	12.5%
7. Utilities and Energy	0%	12%	68%	0%	25%	50%
8. Financial	24%	39%	45%	22%	28%	32%

Figure 3 shows the same results for UDR in a more visual form. This analysis so far shows that even a small interest rate increase of 4% will be dangerous to several firms in construction, finance, utilities and energy, industry or trade.

[10] Assume that firms that report zero interest payments, and hence have zero implied interest rate continue to have zero interest rate (i.e. interest rate increase affects only those borrowers who report non-zero interest expense). Also, a few outlier observations for which reported interest rate was above the 99% percentile of the interest rate distribution were removed and not used in the analysis.

Figure 3. Interest Rate Simulations for Uncovered Debt Ratios



4.2 Shocks to Earnings

In addition to stressing the interest payments, corporate data allows for simulations and stress tests of shocks to corporate earnings. The EBITDA is the key ingredient in the calculation of interest coverage and uncovered debt ratios discussed above. Shocks to corporate earnings, i.e. to EBITDA, will be directly reflected in corporate ability to repay their debts.

While the interest rate shocks were the same as in bank stress testing scenarios, the earnings shocks are not directly comparable to macro economic bank stress testing scenarios. Therefore, we develop separate scenarios for earnings shocks based on historical volatility of earnings. Table 9 reports historical median growth rates in EBITDA by sector. The firm-level yearly EBITDA growth is calculated, then the sector-level median is reported for each year.[11] One observation from Table 9 is high volatility of EBITDA growth – with wide swings between periods of high growth, or high contraction. [12]

[11] Table 4 reports nominal growth rates. Inflation in Jordan was ranging between 1.5-6% in the years in the sample. Thus, real growth rates would be adjusted by the inflation rates.

[12] Note that the growth rates are calculated only using the balanced panel, to prevent differences in sample composition, i.e. the fact that not all firms have data for all years, from affecting the results.

Table 9. Historical Sectoral Median Growth in EBITDA

Year	1. Mining	2. Industry	3. General Trade/Services	4. Construction	5. Transportation	6. Tourism and Hotels	7. Utilities and Energy	8. Financial/ Real Estate	Real GDP growth Rate
2001	-26%	-2%	9%	-34%	-65%	-64%	-17%	-38%	5.3%
2002	-19%	-19%	-2%	-43%	-18%	69%	-13%	-33%	5.8%
2003	14%	-14%	2%	20%	-57%	-27%	8%	21%	4.2%
2004	8%	-19%	48%	73%	31%	102%	4%	10%	8.6%
2005	45%	20%	-48%	12%	224%	83%	2%	53%	7.1%
2006	-17%	-36%	2%	33%	-119%	-16%	38%	-71%	6.3%
Largest Drop in a year	-26%	-36%	**-48%**	**-43%**	**-119%**	**-64%**	-17%	**-71%**	
Second largest drop	-19%	-19%	-2%	-34%	-65%	-27%	-13%	-38%	

Most industries have experienced a drop in earnings of at least 25% (except utilities and energy for which the lowest drop is 17%). Over half of sectors have experienced a drop of close to 50%.

Based on historical volatility in EBITDA growth, two scenarios for earnings stress tests were developed: drop in earnings by 25% and drop in earnings by 50%. The procedure for stressing the earnings is similar to the procedure of stressing the interest rates, as follows:

1. Assume a decrease in current EBITDA of 25% or 50% depending on scenario.
2. Recalculate new interest coverage ratios using new EBITDA with old interest expense.
3. Based on new interest coverage, calculate a new proportion of firms with interest coverage below 0.75 and new uncovered debt ratio.
4. Compare new uncovered debt ratios for shocks scenarios of decreased earnings to the baseline (i.e. actual 2006 levels).

Table 10 reports results of this simulation exercise. The overall impact of change in earnings is milder than the shocks to interest rates considered earlier. It takes a large change in earnings to produce significant changes to ICR and UDR.

For example, in construction, industry and finance sectors there is no impact of lower earnings drop, but there is an impact of higher earnings drop. In the trade sector even the smaller

earnings drop has an impact on UDR and ICR. Utilities do not show any reaction to the earnings drop, while there was a significant impact of the interest rate shocks.

Table 10. Simulation of Earnings Shocks

	UDR			Proportion of firms with ICR below 0.75		
Sector	Baseline	Earnings drop 25%	Earnings drop 50%	Baseline	Earnings drop 25%	Earnings drop 50%
1. Mining	0.5%	0.5%	0.5%	9%	9%	9%
2. Industry	19%	19%	32%	25%	27%	33%
3. General Trade/Services	21%	28%	28%	24%	28%	28%
4. Construction	27%	27%	52%	22%	22%	33%
5. Transportation	3%	3%	3%	30%	30%	30%
6. Tourism and Hotels	7%	7%	7%	12.5%	12.5%	12.5%
7. Utilities and Energy	0%	0%	0%	0%	0%	0%
8. Financial	24%	24%	39%	22%	22%	27%

Overall, the stress testing analysis shows that the most vulnerable sectors are construction, finance, industry and trade.

4.3 Assumptions and Caveats

As in any empirical exercise, there are a number of assumptions and caveats that must be kept in mind when applying the results for policy analysis. Below we discuss key assumptions that were made in the study and some caveats.

First, financial statement data only available on publicly listed firms. Thus, it is assumed that all firms in the sector behave similarly to publicly listed firms. In fact, smaller companies might behave differently. However, the analysis of ASE listed companies by size shows higher vulnerability in smaller listed companies. Therefore, the results obtained from large listed companies might be conservative estimates of the overall impact (as the impact on smaller companies might be larger).

Second, sectoral classification may not be precise (i.e. how ASE is classifying companies and how banks are classifying the same companies might be different).

Finally, corporate data might be noisy and imprecise. Implied interest rates for each company are calculated as interest expense over total debt. These are very rough approximations of actual interest rates paid by the company. Many companies record low implied interest rates, even below 1 percent. Some companies report zero interest expense with non-zero debt. In addition, corporate statements do not allow for precise identification of total bank debt; total debt is approximated as total liabilities minus accounts payables

5. Conclusion

The results of the corporate stress tests suggest that both earnings and interest rate shocks have significant impacts on corporate vulnerability. For Jordan, the results of the tests show that there are a number of firms in the construction, financial and real estate sectors, and in the industry and trade sectors that will be negatively affected by shocks to interest rates or earnings. These stress tests highlight the importance of assessment of corporate vulnerability and including it in bank stress tests.

Because different banks have different sector exposures, and different sectors exhibit different vulnerability at different times, the stress tests that include corporate exposure will provide a more precise evaluation of bank soundness. The estimated NPLs can be used in bank stress testing to evaluate the capital adequacy of the banks.

References

Altman, 2000, Predicting financial distress of companies: Revisiting the Z-score and Zeta Models, *Stern School of Business, New York University*, mimeo.

Altman and Hotchkiss, E., 2005. Corporate Financial Distress and Bankruptcy. 3rd edition. John Wiley & Sons, New York.

Jones, Matthew and Meral Karasulu, 2006, "The Korean Crisis: What did we know and when did we know it? What stress tests of corporate sector reveal" IMF Working paper WP/06/114.